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Appellant:	McLean
Serial No.:	09/656,808
Group Art Unit:	2837
Filed:	September 7, 2000
Examiner:	E. San Martin
For:	TUNED HELMHOLTZ RESONATOR USING CAVITY FORCING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

SECOND APPEAL BRIEF

Subsequent to the Notice of Appeal sent via facsimile to the Patent and Trademark Office on October 27, 2003, Appellant now submits its Second Appeal Brief. Fees in the amount of $330.00 were remitted with the Appellant's first Appeal Brief, and as a result, Appellant believes no further fees are due since the Examiner withdrew his rejection in the response to the Appeal. However, if any further fees are necessary, you are hereby authorized to charge Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds, PC.

REAL PARTY IN INTEREST

The real party in interest Siemens Canada Limited of Tilbury, Ontario, Cananda. Siemens Canada Limited is the Assignee of all right and title in this Application from the inventor.

RELATED APPEALS AND INTERFERENCES

There are no pending related appeals or interferences. However, an earlier Appeal Brief was filed by Appellant on January 6, 2003 to which the Examiner responded by withdrawing the finality of the rejection and issuing a new rejection under a different combination.

STATUS OF CLAIMS

Claims 2, 4-12, and 14-20 stand finally rejected, and more specifically, all of the claims stand rejected under §103(a) over Geddes in view of Brackett. The final rejection of all of the pending claims is being appealed.

STATUS OF AMENDMENTS

All of the amendments have been entered.

SUMMARY OF THE INVENTION

Referring to page 1 of the Specification, internal combustion engines produce undesirable induction noise which adversely affects the output torque and volumetric efficiency of the engine. The induction noise produced by the engine depends on the particular engine configuration and is

affected by such factors as the number of cylinders, the volume and shape of the intake manifold plenum and intake runners, and other induction system parameters. The induction noise is caused by a pressure wave that travels away from the combustion chamber toward the inlet of the air induction system. The induction noise may be reduced and the engine performance improved by producing a wave traveling in the direction of the combustion chamber 180° out of phase of the noise wave. To this end, noise attenuation devices have been developed.

A Helmholtz resonator is one widely used noise attenuation device. The Helmholtz resonator produces a pressure wave that counteracts primary engine order noise waves, which have the greatest negative impact on engine performance. Helmholtz resonators typically provide a passive response targeted at a particular band width of noise. Because the Helmholtz resonator typically provides a passive response, losses occur which decrease the overall effectiveness of the resonator by producing a pressure wave having a narrower bandwidth and smaller amplitude than desired. Variable Helmholtz resonators have been developed, which vary the volume of the resonator to vary the band width at which the resonator attenuates noise. However, these variable resonators do not address the passive losses associated with the Helmholtz resonator. Accordingly, it is desirable to widen the band width of a Helmholtz resonator to further attenuate noise and increase the performance of the engine.

Referring to page 3 of the Specification, an internal combustion engine 10 is shown in Figure 1. An air induction system 12 provides air to the engine 10 for mixture with fuel. The air/fuel mixture is burned in a combustion chamber. Air is provided from the atmosphere through an air intake 20 that feeds air through a filter box 18. The air travels along passageway 24 through

a throttle body 16 which controls the amount of air that travels through the passageway 24 to the engine 10. The air is fed to an intake manifold 14 which then distributes the air to the combustion chambers through runners 15. During the combustion process noise pressure waves N are produced in the induction system 12 which reflect back into the combustion chambers and negatively effect engine performance.

A Helmholtz resonator 28 is shown in fluid connection with the passageway 24 to produce noise attenuating pressure waves which at least partially cancel the noise pressure waves N. Primary order engine noise, or the most undesirable engine noise, is related to the speed of the engine. Helmholtz resonators are designed to attenuate noise at the primary order. The frequency at which the primary order engine noise occurs is: number of cylinders/2 x engine speed/60.

The Helmholtz resonator which is shown in Figure 2 includes a chamber 30 defining a cavity 32. A neck 34, which is shown as a tubular structure, extends from the chamber 30 and is in fluid communication with the cavity 32. The volume defined by the cavity 32 and the area of the neck 34 largely effect the band width of the noise attenuating frequency. The Helmholtz resonator 28 produces a passive response R_p that is approximately 180° out of phase from the noise wave N, shown in Figure 3. The passive response R_p has a bandwidth narrower and an amplitude smaller than desired.

Referring to page 4 of the Specification, the resonator 28 is shown arranged between the throttle body 16 and the intake manifold 14. However, it is to be understood that the resonator 28 may be arranged anywhere along the induction system 12. Preferably, the resonator 28 is arranged between the throttle body 16 and the intake manifold 14 because the largest portion of

the noise pressure wave is reflected from the throttle body 16 back to the intake manifold 14. With the resonator 28 arranged as shown in Figure 1, a larger portion of the noise pressure wave may be attenuated by the resonator 28.

The present invention increases the band width of the resonator 28 by producing a forced response R_f shown in Figure 3. The forced response supplements the passive response R_p and together provide a wider band width and higher amplitude than the passive response from the Helmholtz resonator 28. As a result, a larger portion of the noise pressure wave may be attenuated. To this end, the present invention utilizes a active resonator, preferably a loud speaker 38, to produce the forced response. The chamber 30 includes a flange 36 to which the loud speaker 38 is attached. The flange 36 has an opening within which the loud speaker diaphragm 40 is disposed. The loud speaker 38 is driven by a driver 50 that drives the diaphragm 40 to produce a pressure wave that supplements the passive response pressure wave R_p. That is, the forced response R_f is in phase with the passive response R_p. The flange 36 includes pressure equalization ports 42 that equalizes the pressure on either side of the flange 36 to permit consistent operation of the resonator 28 of the present invention in various altitudes and changing atmospheric pressures. The equalization ports 42 are small enough to prevent pressure waves from exiting the cavity 32 through the equalization ports 42 so that the noise attenuating and pressure wave will not escape but will be directed to the noise wave. Preferably the pressure equalization ports 42 are about 1/8 inch in diameter.

Since the Helmholtz resonator 28 is designed to attenuate noise produced at the primary engine order, the driver 50 preferably includes a signal source 52 that senses the speed of the

engine. Continuing on page 5 of the Specification, such signals are commonly produced by proximeters that read notches on a timing gear. The speed signal is used by an ECU 58 for devices such as the tachometer and engine control. The signal source 52 is sent to a phase compensator 54 that adjusts the sinusoidal output from the signal source 52 so that it is approximately 180° out of phase with the noise pressure wave. The phase compensator 54 adjusts for such parameters as the speaker response, the volume response of the Helmholtz resonator, and the neck response of the Helmholtz resonator. These parameters may be determined through experimentation during the engine development process. An audio amplifier 56 amplifies the signal from the phase compensator 54 which is typically a low voltage signal. The signal from the audio amplifier 56 drives the loud speaker 38 to produce the forced response. The forced response R_f and passive response R_p, which are of wider band width and greater amplitude, are radiated back to the engine 10 to increase the engine performance.

ISSUE

Is the rejection of claims 2, 4-12, and 14-20 proper under §103(a) over Geddes in view of Brackett given:

1) there is no motivation to combine the references to provide the limitations of claim 8;

2) there is no benefit in combining the references to provide the limitations of claims 9 and 10 in light of their teachings; and

3) Brackett does not suggest use of an engine signal as claimed by the Examiner?

GROUPING OF CLAIMS

The term "contested" means that Appellant is appealing the rejection provided by the Examiner to the particular claim or claims. The claims are grouped together by letter, and the claims within a particular group stand or fall together. However, the claims of one group do not stand or fall with the claims of another group.

A. Claims 2, 4-8, 11, 12, and 14 are contested.

B. Claims 9 and 10 are separately contested.

C. Claims 15-20 are separately contested.

ARGUMENTS

A. Geddes and Brackett do not disclose all of the limitations of claim 8

Claim 8 is an independent apparatus claim. Claims 2, 4-7, 11, 12, and 14 depend from claim 8 and are not separately argued under this section.

The Examiner has responded on May 27, 2003 to Appellant's response mailed April 17, 2003 by making two arguments: 1) Brackett is not non-analogous art because both references are directed to the same problem, which is to attenuate noise in an exhaust, and 2) although the motivation is not expressly articulated, the references as a whole teach Appellant's invention.

With respect to the Examiner's first argument, nowhere does the Appellant argue that the reference are non-analogous art. Rather, Appellant is pointing out that the combination is flawed. Geddes is the base reference, which the Examiner is modifying with Brackett. The Examiner makes the statement on page 2 of the Office Action regarding claim 8 that Geddes teaches an

induction noise system. This is wrong. An induction system is on the air inlet side of an engine; Geddes is on the outlet or exhaust side. This distinction is related to why one of ordinary skill in the art would not combine the references.

More specifically, Geddes teaches of an exhaust system using an active noise cancellation system sensing actual noise. In contrast, Brackett is directed to an induction system having a passive noise cancellation that relies upon engine speed to predict noise cancellation. Specifically, Geddes is concerned with reducing the sound level of the exhaust gases flowing through the exhaust conduit and in particular, combining the invention with a muffler do reduce the high frequency noise (see column 4, ll 21-24). Prior art methods have used baffles which inhibit the flow of gases through the system thereby inhibiting the economy and performance of the vehicle as set forth in column 1, lines 21-37. Also, Geddes utilizes an active noise cancellation system by detecting the actual noise in the system and producing a sound wave to cancel the noise sensed.

Brackett does not deal with noise cancellation in an exhaust system whatsoever, nor does Brackett address the concerns in the prior art discussed in Geddes of minimizing the obstructions in the exhaust system (i.e. restructure muffler) or any other passages to reduce noise. The induction system in Brackett does not have component similar to a muffler. Accordingly, there is no suggestion or motivation to one of ordinary skill in the art to modify Geddes to provide the missing limitations. Column 2, line 59 – Column 3, line 35 referred to by the Examiner in the September 26, 2003 Advisory Action support the Appellant's position against combining because Geddes' teaching here is directed to overcoming the corrosive environment and high temperatures experienced in exhaust.

With respect to the Examiner's second argument, as discussed in the previous paragraph taking the teachings of the references as a whole would not motivate one of ordinary skill in the art to modify Geddes with Brackett. The systems of Geddes and bracket are incompatible and are concerned with different problems. The Examiner is using hindsight and picking and choosing the elements missing from the base reference. All engine noise attenuation devices are for reducing noise and improving torque. The Examiner cannot possibly be arguing that he can therefore combine any reference from that art without being accountable for their teachings in the context of the problems being solved.

To further illustrate this point, who would one or ordinary skill not just relocate the noise attenuation device of Geddes to the intake side? Clearly, the Examiner is using hindsight.

B. There is no benefit to combine Geddes and Brackett to yield the limitations of claims 9 and 10

Claims 9 and 10 depend from claim 8, but are additionally allowable for the reasons set forth below.

There must be some benefit to combining the references in order to suggest or motivate one of ordinary skill in the art to modify the base reference, Geddes. Absent some benefit, Brackett and Geddes cannot properly be combined. Geddes discloses a transducer arrangement for active noise cancellation for exhaust systems. A sensor 12 and a feedback sensor 24 are arranged in space relationship along the exhaust system. Specifically, the sensor 12 is arranged between the catalytic converter 54 and the muffler 56, and the feedback sensor 24 is arranged

between the terminal end of the exhaust system and the noise cancellation housing 58. The sensors 12 and 24 measure the actual noise in the exhaust system and send a signal to the electronic controller 60. Based upon the actual noise sensed the controller 60 generates a signal to the loud speaker to actively cancel the noise.

Measurement of engine speed as taught by Brackett provides no benefit in Geddes. That is, it does not matter in Geddes what the engine speed is, but only the actual noise in the exhaust system. Using engine speed is an indirect way of determining noise, which must then be calculated using numerous equations to predict what the noise may be in the system. The calculations are base on a model that may not be accurate from vehicle to vehicle based upon different component configurations and tolerances. Measuring actual noise in a system enables the production of a noise cancellation wave for the particular configuration for that particular vehicle.

If one were already measuring the actual noise, what would motivate one to also estimate it by measuring some other parameter such as the engine speed in Brackett? To do so would be duplicative and provide less accurate results. The Examiner argues that one would modify Geddes to improve engine torque, but does not explain why one needs an engine speed signal. Engine torque is already improved in Geddes by the active noise system used in the exhaust which employs transducers measuring the actual noise. As a result, there is not motivation for one of ordinary skilled in the art to combine Brackett and Geddes to obtain Appellants invention as defined in the claims.

C. The use of engine speed is not obvious as argued by the Examiner in rejecting claim 15

Claim 15 is an independent method claim having a similar limitation to claim 9 relating detecting engine speed. Claims 16-20 depend from claim 15. There is no benefit in combing Geddes and Brackett as argued above relative to claims 9 and 10.

Brackett stands for the proposition that use of a noise attenuation device improves the engine torque curve (see Brackett Abstract), independent of whether engine speed is used. The particular system disclosed in Brackett uses a speed signal. However, employing a speed signal does not necessarily make a noise attenuation system better. In fact, an engine speed signal may provide no advantage. Brackett is actually less accurate in theory than Geddes in that it can only predict the noise, as explained above relative to claims 9 and 10. Accordingly, there is no benefit to combine the references.

CLOSING

For the reasons set forth above, the final rejection of all claims is improper and must be reversed. An early indication of such is earnestly solicited.

Respectfully submitted,

CARLSON, GASKEY & OLDS

William S. Gottschalk
Registration No. 44,130
400 W. Maple, Suite 350
Birmingham, MI 48009
(248) 988-8360

Dated: December 29, 2003

CERTIFICATE OF MAIL

I hereby certify that the enclosed **Appeal Brief (in triplicate)** is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to Mail Stop AF, Commissioner For Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on December 29, 2003.

Amy M. Spaulding

CLAIM APPENDIX

2. The Helmholtz resonator according to claim 8, wherein said neck is a tubular structure extending from said chamber.

4. The Helmholtz resonator according to claim 14, wherein said loudspeaker is a woofer.

5. The Helmholtz resonator according to claim 14, wherein said chamber includes a flange with said loudspeaker supported thereon, and said loudspeaker having a diaphragm disposed within an opening in said flange for producing said forced response.

6. The Helmholtz resonator according to claim 5, wherein said flange includes at least one pressure equalization port there through in fluid communication with said cavity.

7. The Helmholtz resonator according to claim 6, wherein said flange is arranged opposite said neck.

8. An induction noise attenuation system for a combustion engine comprising:

a portion of an air induction system defining a passageway arranged between an intake manifold and a throttle body carrying a sound wave;

a Helmholtz resonator having a chamber at least partially defining a cavity and a neck in said chamber fluidly connecting said portion of said air induction system and said cavity, said chamber and said neck producing a passive response to said sound wave;

an active resonator disposed within said chamber; and

a driver connected to said active resonator producing a signal for driving said active resonator and producing a forced response for supplementing said passive response.

9. The system according to claim 8, wherein said driver includes a signal source that detects a speed of the combustion engine for synchronizing said forced response relative to said speed.

10. The system according to claim 9, wherein said signal source is engine RPM.

11. The system according to claim 9, wherein said driver includes a phase compensator for synchronizing said forced response approximately 180° out of phase with said sound wave.

12. The system according to claim 9, wherein said driver includes an amplifier for amplifying a signal from said signal source.

14. The system according to claim 8, wherein said active resonator is a loudspeaker.

15. A method of attenuating noise in an induction system comprising:

a) sensing an engine speed;

b) producing a phase compensated engine speed signal;

c) driving a loudspeaker with the phase compensated engine speed signal; and

d) propagating a sound wave with the loudspeaker to attenuate the noise in the induction system.

16. The method according to claim 15, further including the step of:

e) amplifying the engine speed signal.

17. The method according to claim 15, further including the step of:

f) propagating a passive sound wave with a Helmholtz resonator, wherein step d) supplements the passive sound wave.

18. The method according to claim 17, wherein step b) includes determining a loudspeaker response.

19. The method according to claim 17, wherein step b) includes determining a Helmholtz resonator cavity response.

20. The method according to claim 17, wherein step b) includes determining a Helmholtz resonator neck response.

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